JOINT STRIKE FIGHTER
PROGNOSTICS AND HEALTH MANAGEMENT

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1998 Technology Showcase - Joint Oil Analysis Program
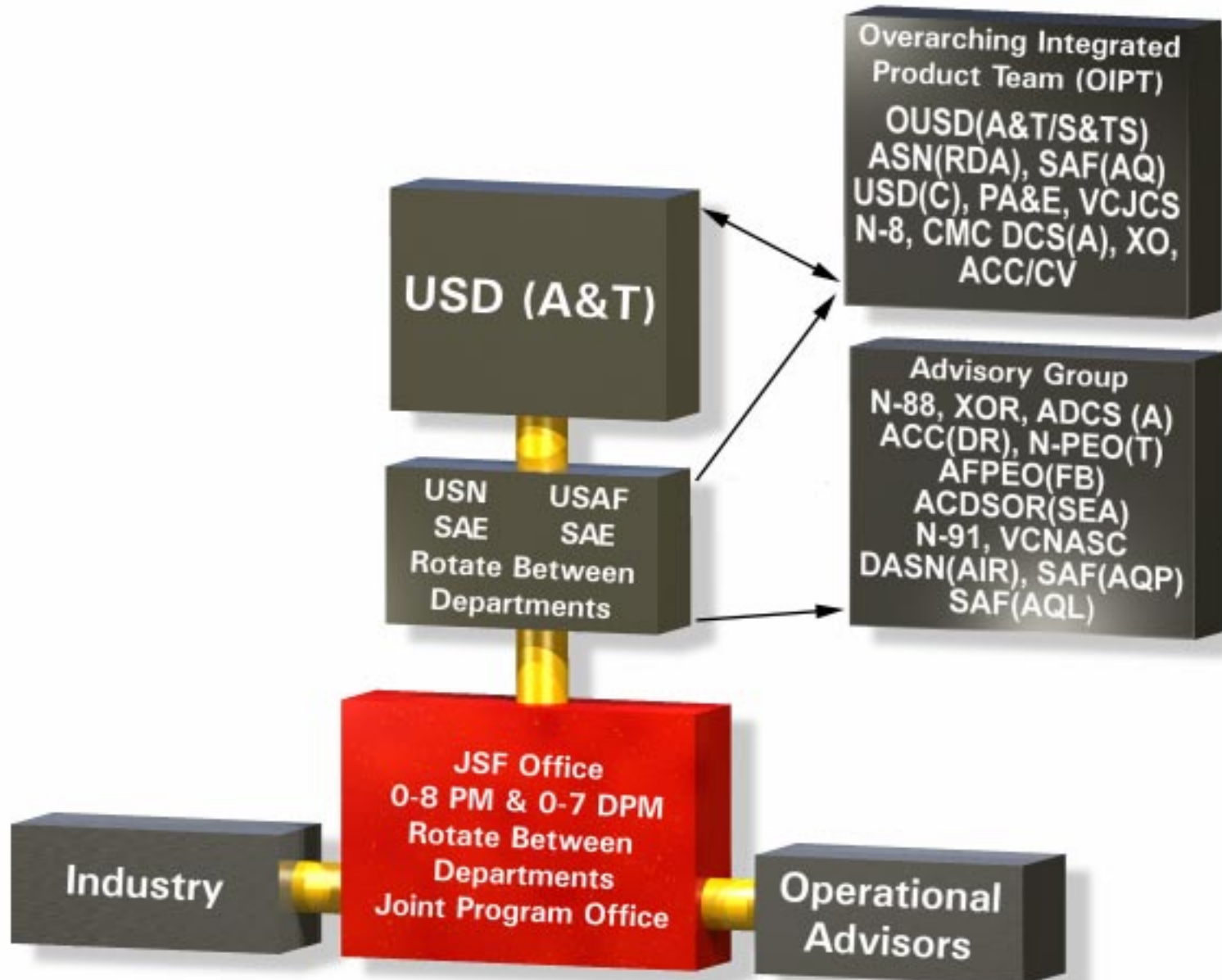
The Next Generation Strike Fighter

VISION

BE THE MODEL ACQUISITION PROGRAM FOR JOINT SERVICE AND INTERNATIONAL COOPERATION

DEVELOP AND PRODUCE AN AFFORDABLE NEXT GENERATION STRIKE FIGHTER WEAPON SYSTEM AND SUSTAIN IT WORLDWIDE

JSF ORGANIZATIONAL RELATIONSHIPS

USD (A&T)

Overarching Integrated Product Team (OIPT)
OUSD(A&T/S&TS)
ASN(RDA), SAF(AQ)
USD(C), PA&E, VCJCS
N-8, CMC DCS(A), XO,
ACC/CV

USN SAE   USAF SAE
Rotate Between Departments

Advisory Group
N-88, XOR, ADCS (A)
ACC(DR), N-PEO(T)
AFPEO(FB)
ACDSOR(SEA)
N-91, VCNASC
DASN(AIR), SAF(AQP)
SAF(AQL)

JSF Office
0-8 PM & 0-7 DPM
Rotate Between
Departments
Joint Program Office

Industry

Operational Advisors

SERVICE NEEDS

- **USN**
  - Multi-role, highly survivable strike fighter to complement the F/A-18E/F

- **USAF**
  - Multi-role (primary air-to-ground) fighter to replace the F-16 and A-10 and to complement the F-22

- **USMC**
  - Multi-role, short takeoff, vertical landing strike fighter to replace the AV-8B and F/A-18C/D
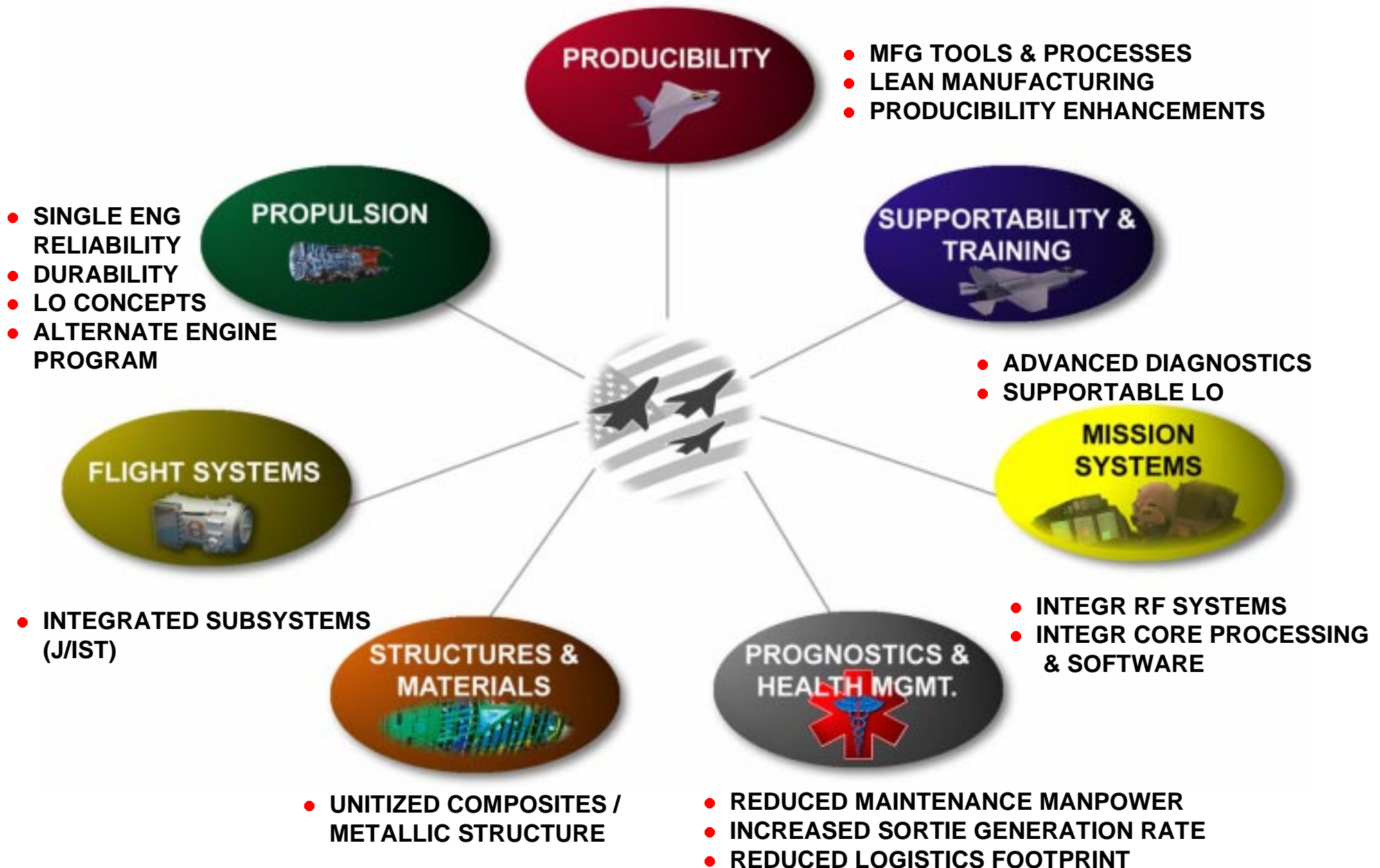
- **ROYAL NAVY**
  - Supersonic STOVL replacement for the sea harrier

KEY TECHNOLOGY MATURATION PROGRAMS

PRODUCIBILITY
- MFG TOOLS & PROCESSES
- LEAN MANUFACTURING
- PRODUCIBILITY ENHANCEMENTS

PROPULSION
- SINGLE ENG RELIABILITY
- DURABILITY
- LO CONCEPTS
- ALTERNATE ENGINE PROGRAM

SUPPORTABILITY & TRAINING
- ADVANCED DIAGNOSTICS
- SUPPORTABLE LO

FLIGHT SYSTEMS
- INTEGRATED SUBSYSTEMS (J/IST)

MISSION SYSTEMS
- INTEGR RF SYSTEMS
- INTEGR CORE PROCESSING & SOFTWARE

STRUCTURES & MATERIALS
- UNITIZED COMPOSITES / METALLIC STRUCTURE

PROGNOSTICS & HEALTH MGMT.
- REDUCED MAINTENANCE MANPOWER
- INCREASED SORTIE GENERATION RATE
- REDUCED LOGISTICS FOOTPRINT

BOEING

USAF CTOL

USN CV

USMC STOVL

UK RN STOVL

LOCKHEED MARTIN

USAF CTOL
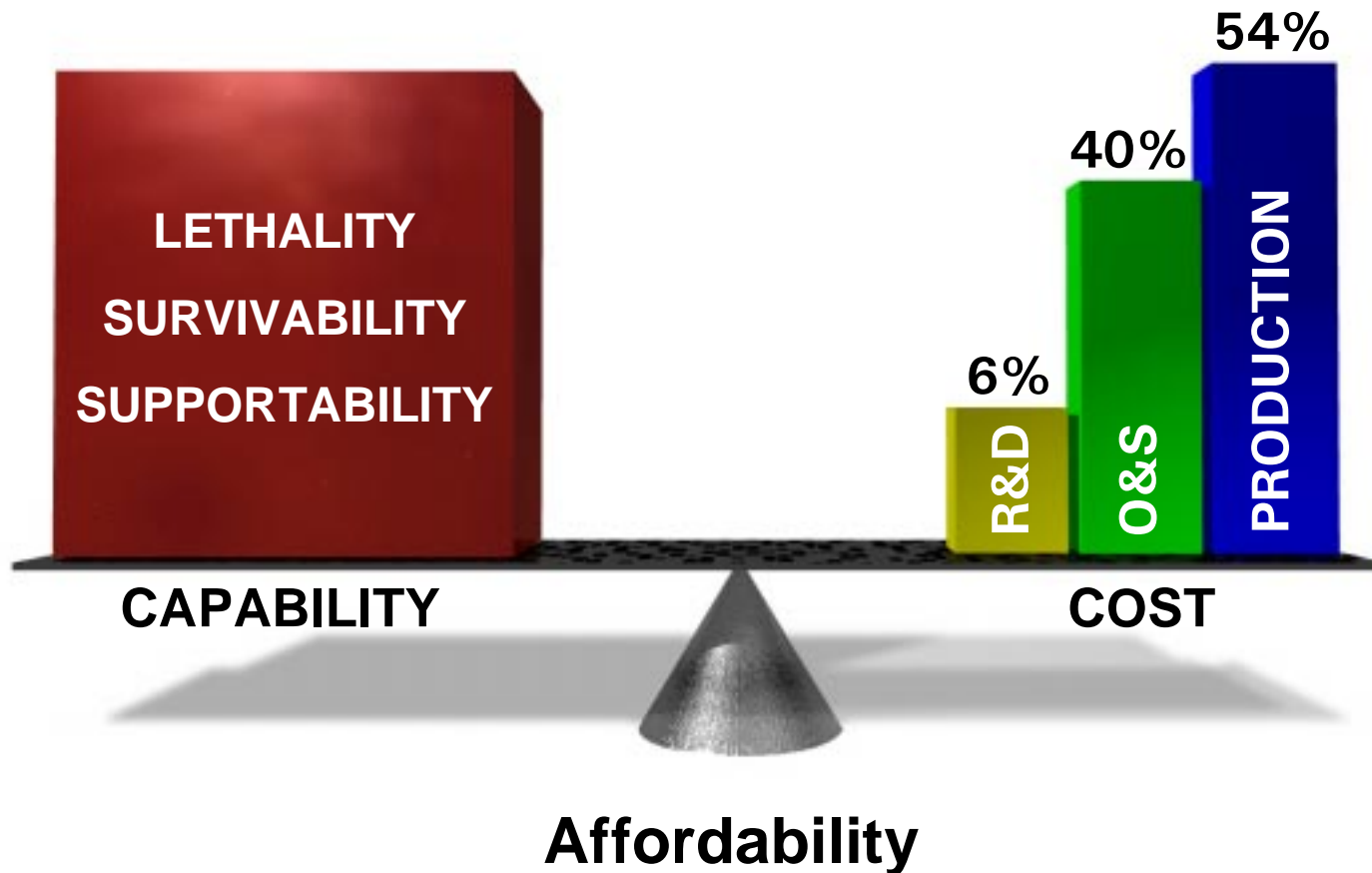

USN CV

USMC STOVL

UK RN STOVL

TACTICAL AIRCRAFT AFFORDABILITY OBJECTIVE

Affordability

Cost Objectives Shall Be Set To Balance Mission Needs With Projected Out-Year Resources, Taking Into Account Anticipated Process Improvements In Both DOD And Defense Industries.

JSF LOGISTICS VISION

The Joint Strike Fighter should be capable of self-deploying to any area of operations, worldwide, with a logistics tail comprised solely of the weapons it will deliver, the fuel needed to fly and the personnel needed to generate initial surge operations. Innovations in information technology and integrated logistics concepts, couple with unprecedented reliability and a robust *Prognostics and Health Management* system, should facilitate a condition-based support and maintenance scheme that can take advantage of cost efficiencies not available to previous weapon systems. Open architectures should be incorporated as part of the basic design to provide the capability to continuously capitalize on emergent technologies that increase readiness through enhanced reliability while driving cost of ownership down over the entire Life Cycle.
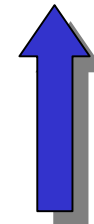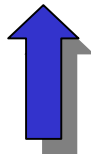
PROGNOSTICS & HEALTH MANAGEMENT

A PARADIGM SHIFT FROM:

Sensor-Based to Intelligent System-Based

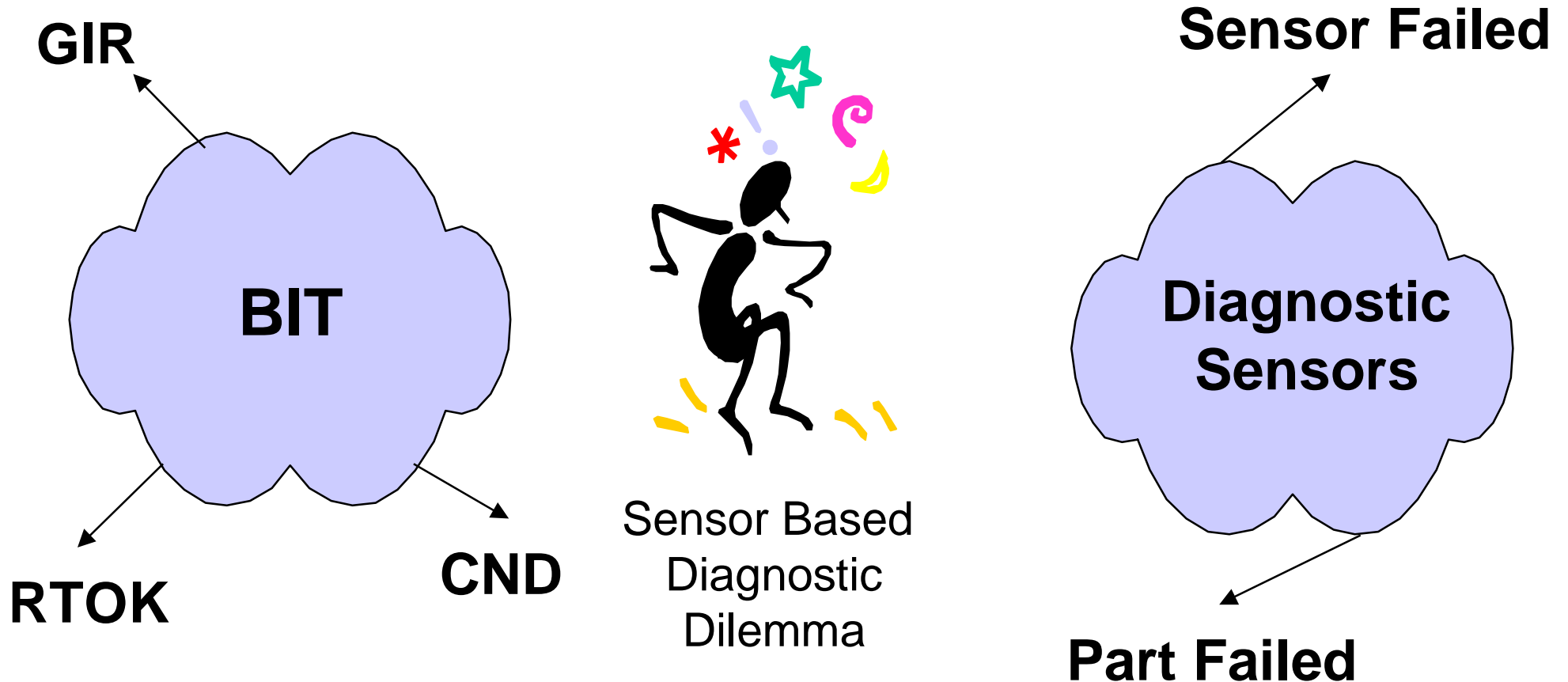Diagnostics to Prognostics

Reactive to Proactive Communications - 3 Rs

F-22 DHM

RITA HUMS

SMART SHIP AUTOMATION

Insanity is doing the same thing over and over and expecting the outcome to change

GIR

Sensor Failed

BIT

Diagnostic Sensors

RTOK

CND

Sensor Based
Diagnostic
Dilemma

Part Failed

MODEL BASED PHM

Sensors

Eddy Current Sensors

Low Power Wireless Integrated Microsensors

Wireless MEMS

JSF

Algorithms

Gabor Transforms
Fast Fourier Transforms
Discrete Fourier Transforms
Wavelets

Reasoners

Rule Based
Model Based
Case Based
Neural Networks
Fuzzy Logic
Genetic Algorithms

PHM GOALS

- **Eliminate Calendar and Component Usage-Based Scheduled Maintenance**

- **Maximize Lead Time for Maintenance and Parts Procurement for Unscheduled Maintenance**

- **Identify Systems for Impending Failures or Problems**

  – Structures, Subsystems, Mission Systems, VMS, Propulsion, Signature, and JDIS are the Focus Areas

- **Provide Real Time Notification and Understanding of an Upcoming Maintenance Event at all Levels of the JSF Logistics Chain**
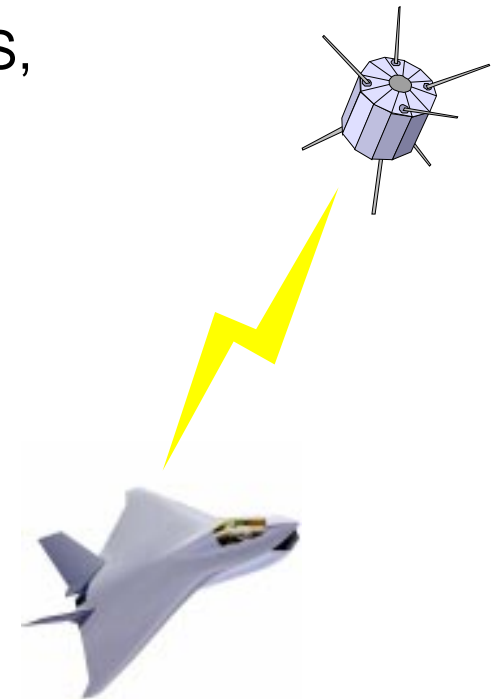
METHODOLOGY

Gather Maintenance Data on Legacy Systems, in Order to Identify Systems which Cause the Largest Maintenance Problems

Do Failure Mode and Critical Effects Analysis on Preferred Weapons Systems

Perform Cost-Performance Trade Off Analysis

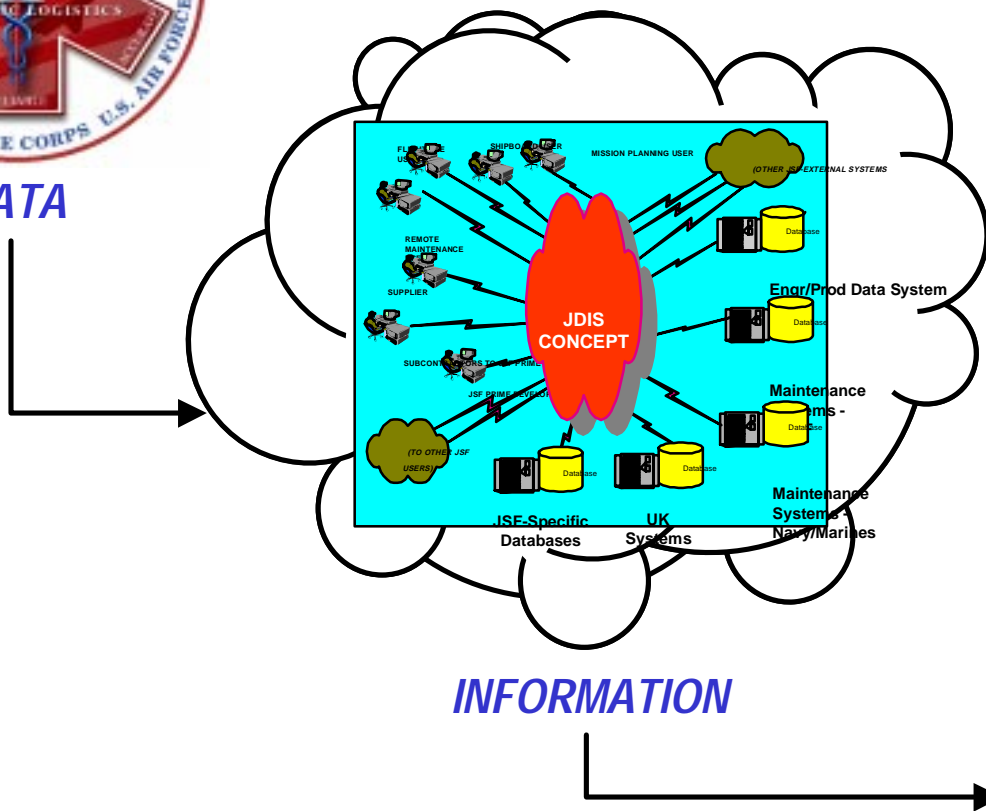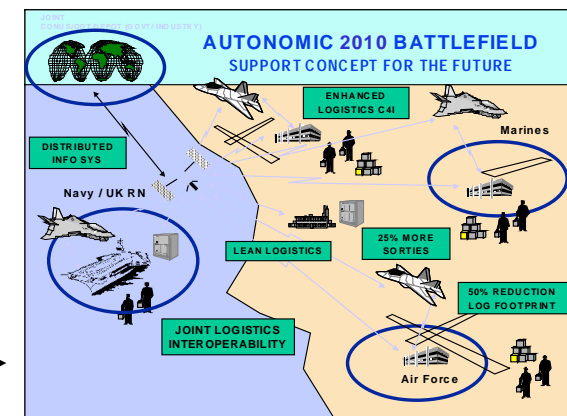Bring High Payoff Enabling Technologies to Maturity

PHM & JDIS ENABLE AUTONOMIC LOGISTICS

DATA

INFORMATION

KNOWLEDGE

JOINT DISTRIBUTED INFORMATION SYSTEM

- **Nerve Center of Autonomic Logistics**
- **Conduit for PHM, Maintenance, and Mission Data**
- **Key for Triggering Logistics Functions**
- **Provides Real-Time Accurate Maintenance and Prognostics Data to All Users**
  - Maintenance
  - Training
  - Supply
  - Engineering
  - Safety
- **Ties All Services Logistics Data Systems Together and Integrates With WSC Engineering Database**

THE JDIS CONCEPT OVERCOMES LIMITATIONS OF CURRENT WEAPON SYSTEM DATA SYSTEMS
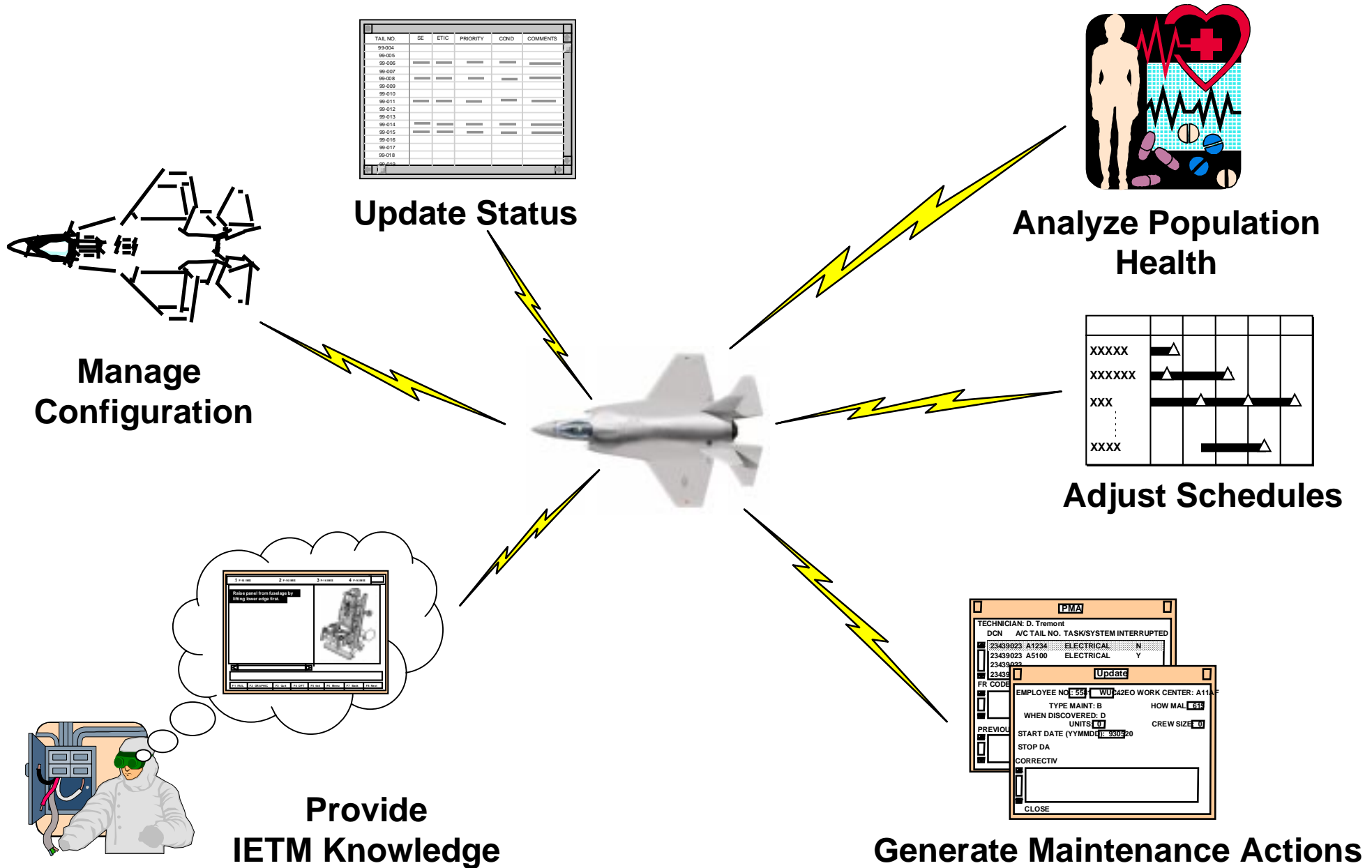
CURRENT SYSTEMS

- Maintenance and Diagnostic Data at Maintainer Locations are Downloaded Periodically from a 'Master Data' Base -- Data May Not Be Current Between Downloads

- Much Labor-Intensive Manual Data Entry and Lookup

- Flight Line Diagnostic Information Not Generally Available at Depot

- Users Must Know Data Locations, File Locations, and Have Working Knowledge of Data Source Systems

- Baseline Design, Manufacturing, and Test Data Reside at Contractor Facilities for a Good Portion of the System's Life Cycle -- EMD through Product Fielding/Deployment & Operational Support

JDIS

- Maintains Real-Time Links to External and Internal Data Sources for Data Currency

- Facilitates Automatic Data Entry and Retrieval via Object-Oriented Data Links

- Facilitates Access to ALL pertinent data

- Facilitates Use of User-Friendly Internet-like Graphical Interfaces

- Provides seamless Access to logically centralized / geographically Dispersed Data Sources

JDIS FUNCTIONALITY

Update Status

Analyze Population Health

Manage Configuration

Adjust Schedules

Provide IETM Knowledge

Generate Maintenance Actions

JDIS FUNCTIONALITY

- **Real-Time Information Exchange:**
  - Text & Graphics
  - Video
  - Voice
  - Multi-Media
  - Virtual Reality
- **Multi-Level Security:**
  - Unclassified
  - Classified
- **Information Integration**
  - Multiple Heterogeneous Data Sources
  - Unified Application Interface
  - Configuration Management
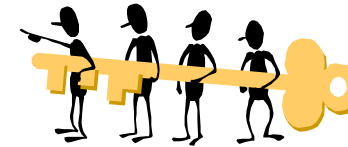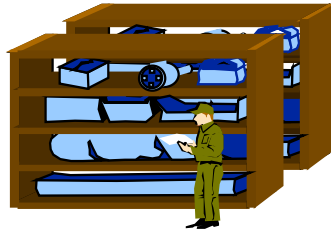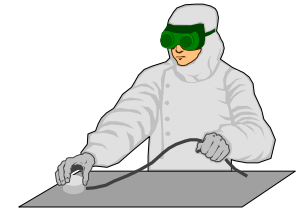 - Terminology Mapping
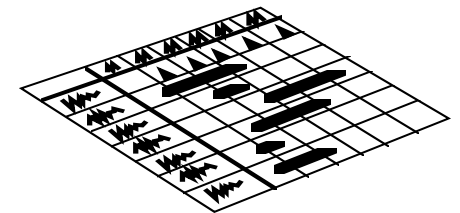
JDIS FUNCTIONALITY

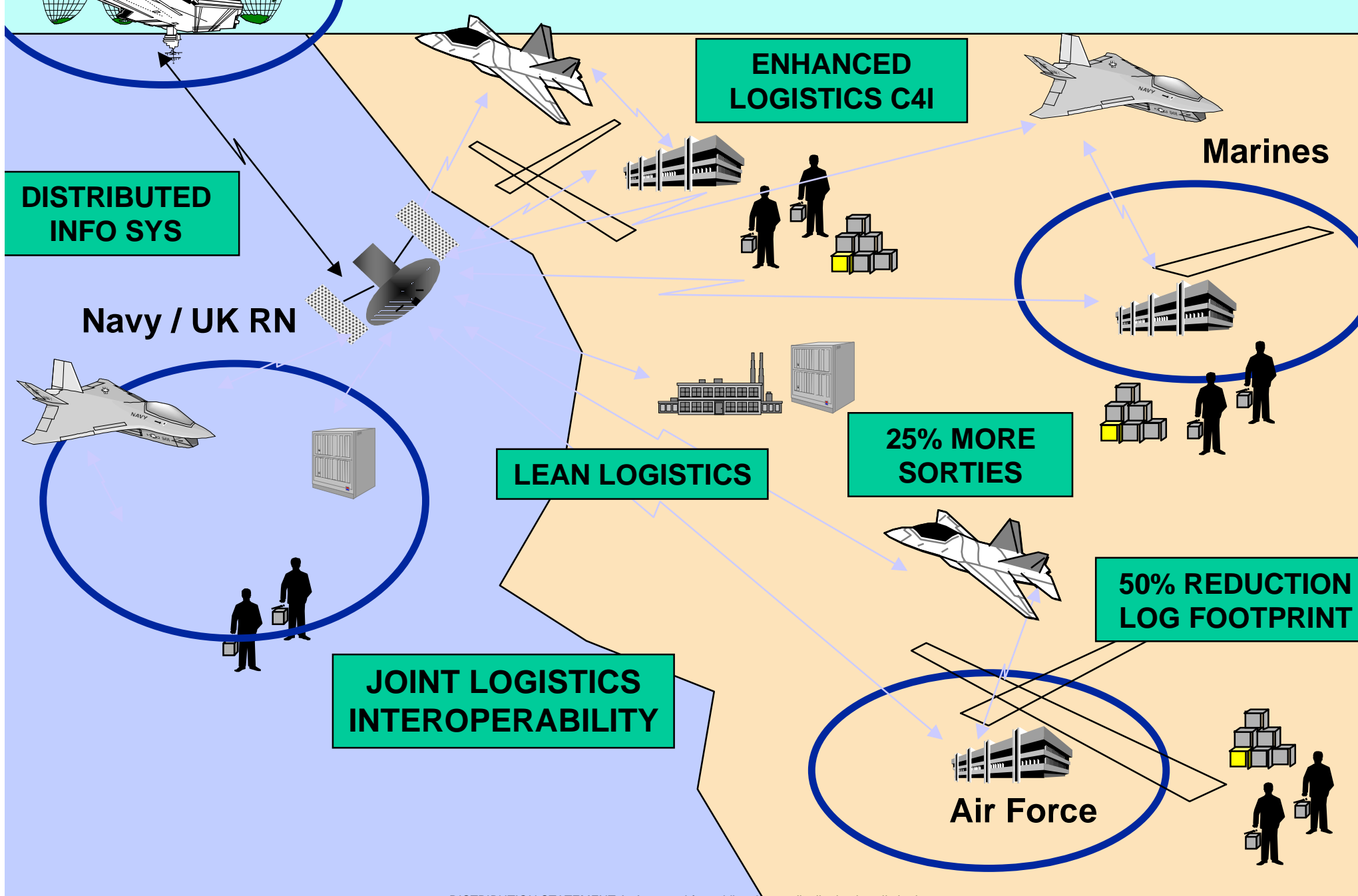**STIMULATES...**

Parts Ordering

Repairs

Design Improvements

Mission Planning

CREATING...

AUTONOMIC RELAY OF KNOWLEDGE

AUTONOMIC 2010 BATTLEFIELD
SUPPORT CONCEPT FOR THE FUTURE

JOINT
CONUS/OOT DEPOT (GOVT/ INDUSTRY)

ENHANCED LOGISTICS C4I

Marines

DISTRIBUTED INFO SYS

Navy / UK RN

LEAN LOGISTICS

25% MORE SORTIES

50% REDUCTION LOG FOOTPRINT

JOINT LOGISTICS INTEROPERABILITY

Air Force

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited

JSF WEBSITE

www.jast.mil

- **GENERAL PROGRAM INFORMATION**

- **ANNOUNCEMENTS (e.g., PROCUREMENTS, AWARDS)**

- **BRIEFINGS**

- **DISSEMINATE SPECIAL INFORMATION (e.g., NEWSLETTERS, MASTER PLAN)**